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Transportation Security Administration

Office of Security Technology

Airport Perimeter Security Projects for FY06

FINAL REPORT

LaGuardia International Airport (LGA)

Friend-or-Foe Identification and Tracking System

U.S. Department of Homeland Security
Transportation Security Administration
Office of Security Technology
Advanced Surveillance Program
701 South 12th Street
Arlington, VA 20598-6016

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OVERVIEW

INTRODUCTION

In fiscal year (FY) 2006, the Transportation Security Administration (TSA) announced opportunities for general perimeter security enhancement projects at airports with typical configurations and existing barriers, such as fencing and concrete barricades. The announcement requested information from airport authorities on existing airport perimeter security vulnerabilities and proposals to mitigate those vulnerabilities through the inventive use of available technologies at intended perimeter access points (such as vehicle gates), perimeter boundaries, and terminals.

In FY 2008, TSA reissued the Airport Perimeter Security (APS) announcement to all airports, along with a second announcement addressing small to medium-sized airports with few or no barriers around their perimeters. The second announcement was for the Virtual Perimeter Monitoring System (VPMS) project intended to test a more elaborate solution that would better fit a smaller airport. The VPMS solution was developed by the Navy.

TSA requested airports provide white papers explaining the security deficiencies to be addressed and proposals, including technologies to be deployed and full life-cycle project cost estimates. 65 airports responded to the FY 2006 request and 35 airports responded to the FY 2008 requests. The airports proposed projects of varying complexity, from installation of a single piece of equipment to sophisticated, integrated systems.

Six airports were selected in FY 2006 to participate in the APS projects. In FY 2008 and 2009, TSA selected six additional airports for participation in APS and three airports for VPMS projects.

The attached report covers the test results of only one of the 15 total test sites. TSA plans to release each report singularly as the test results are completed and made available.

IMPLEMENTATION

The Port Authority of New York and New Jersey (PANYNJ) implemented a Friend-or-Foe identification and tracking system at LaGuardia International Airport (LGA) through the use of APS program resources that were provided by TSA. National Safe Skies Alliance (Safe Skies), in cooperation with PANYNJ, conducted an independent verification and validation (IV&V) evaluation of the Friend-or-Foe system. Evaluation efforts took place at LGA, and were concluded July 24, 2009.

The Friend-or-Foe system was conceptualized to combine the capabilities of a remote biometric fingerprint authentication system with a Radar Identification (RAID) system in order to create a new form of access control and monitoring system that covers the outer perimeter areas of the

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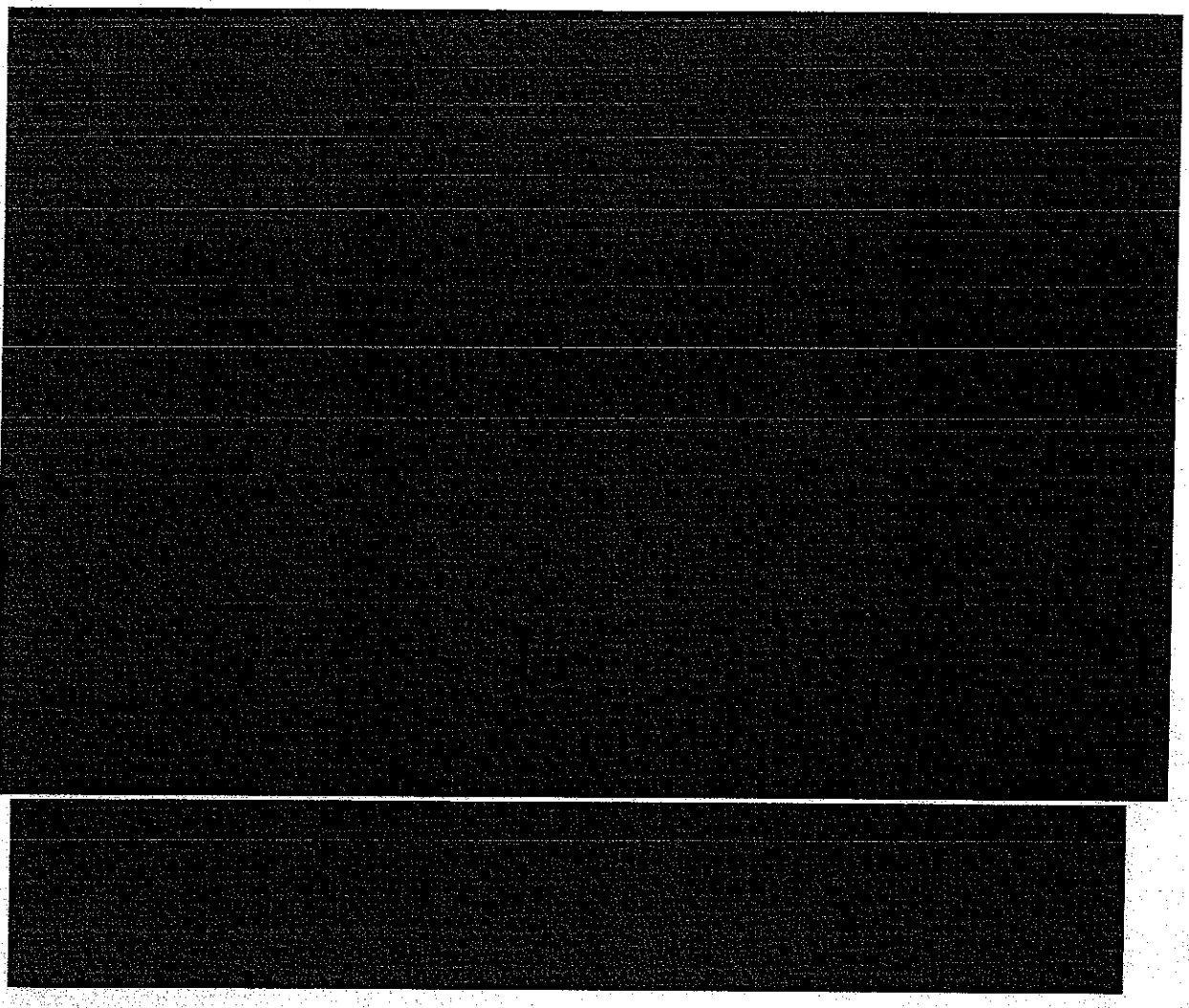
facility. The system leveraged the Federal Aviation Administration's (FAA) Airport Surface Detection Equipment (ASDE-3 radar) to provide real-time radar tracking data for the Airport Security Display Processor (ASDP), which enabled active tracking and monitoring capabilities, while a new form of Biometric Radio Frequency Identification (Bio-RFID) badge would provide remote biometric fingerprint authentication. Both technologies, ASDE-3/ASDP and Bio-RFID, were integrated so that a fusion of the data could be displayed on a single Common Operating Picture (COP) and installed in the Operations Control Center (OCC).

The Safe Skies Lead Test Engineer (LTE) generated a site survey document based on a preliminary survey of the locations prior to the deployment of the security technology improvements. The LTE developed operational testing procedures used as the basis for determining if the system met the security requirements of LGA airport authorities. Representatives of TSA, Safe Skies, and LGA convened to discuss and verify the system requirements prior to the implementation of evaluation procedures. The resulting operational data was analyzed by the Safe Skies statistical team and combined with the site survey information to generate the final report.

SUMMARY



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In addition to the work performed by the testing team, the LGA security personnel collected data from across the whole ASDE-3 coverage range, including the water and land areas near and

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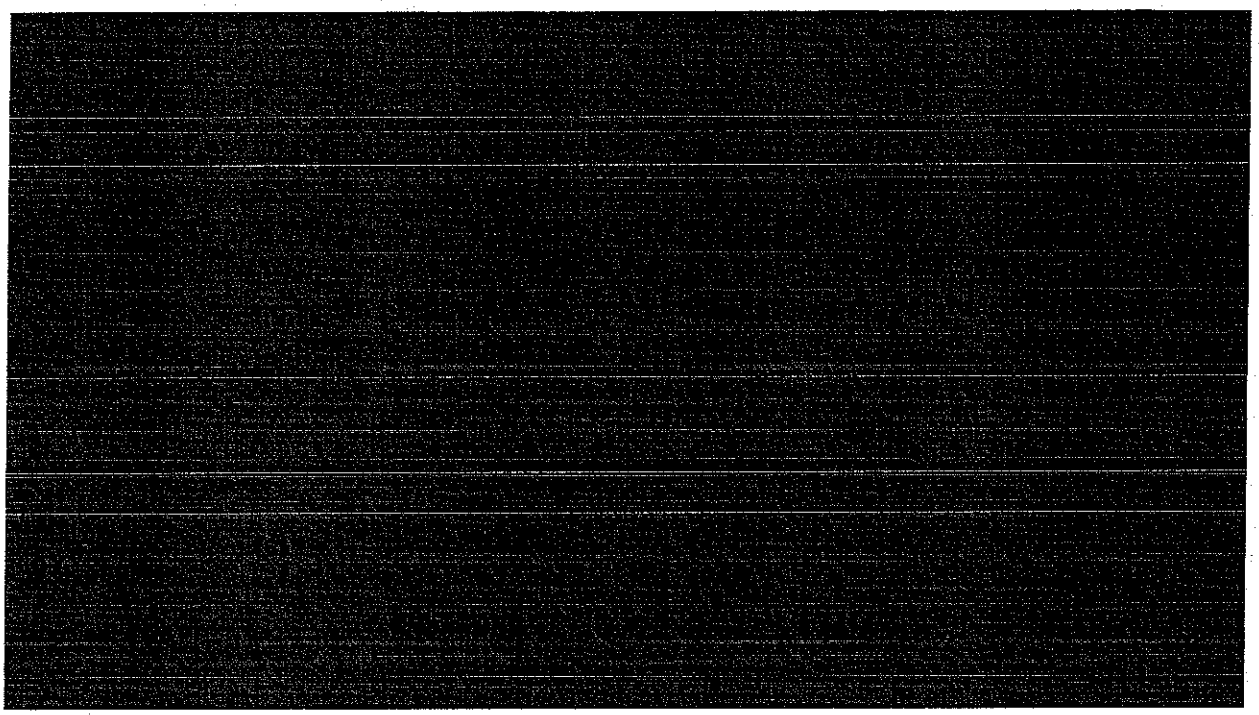
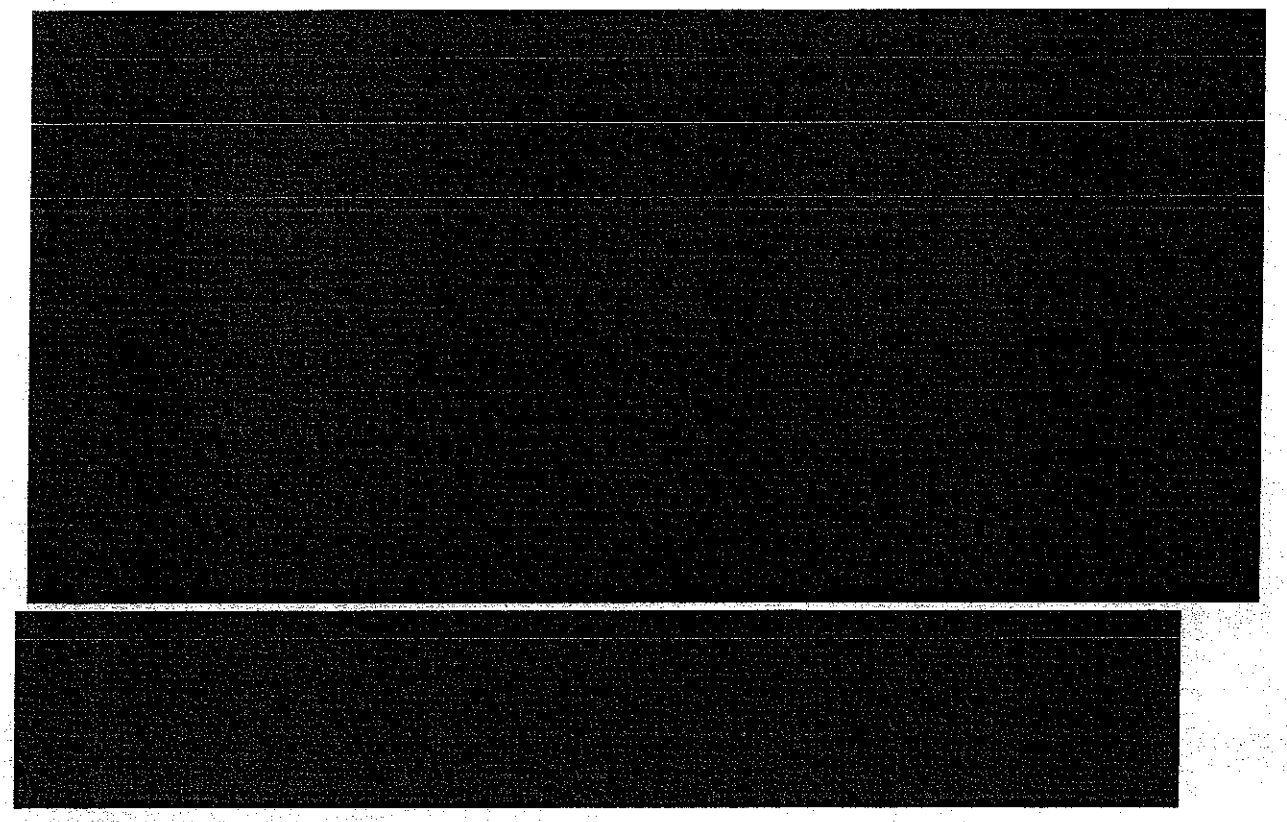
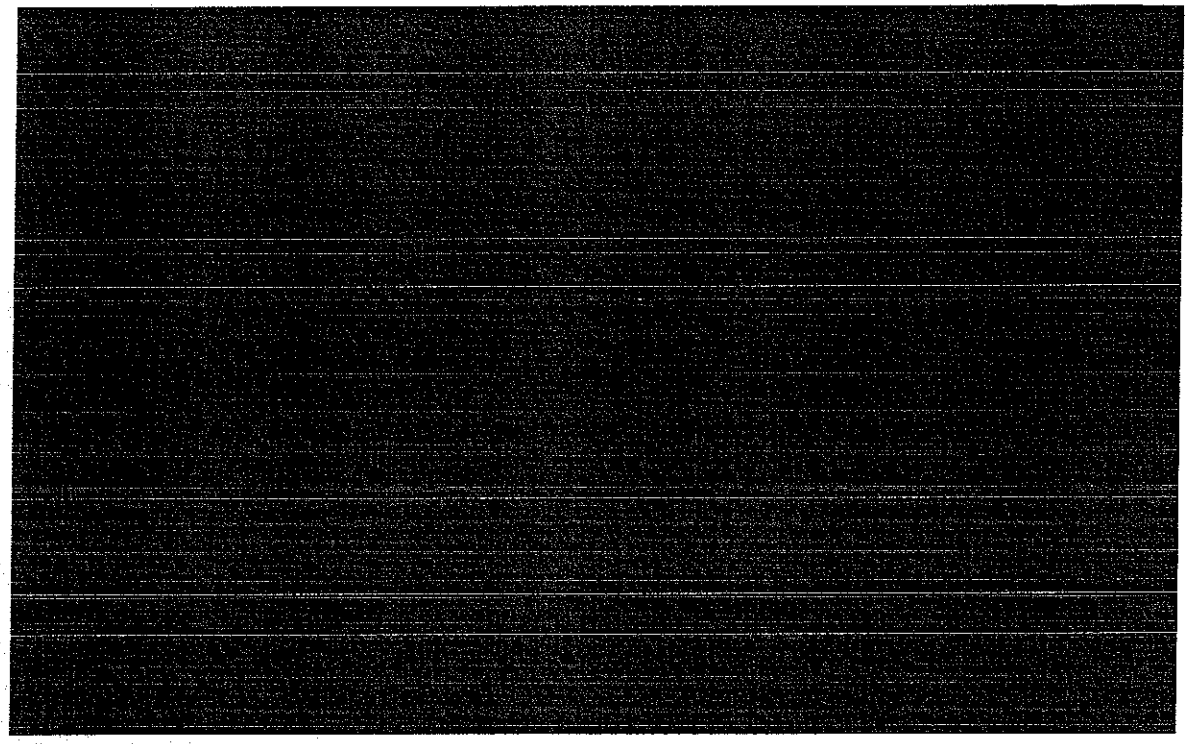
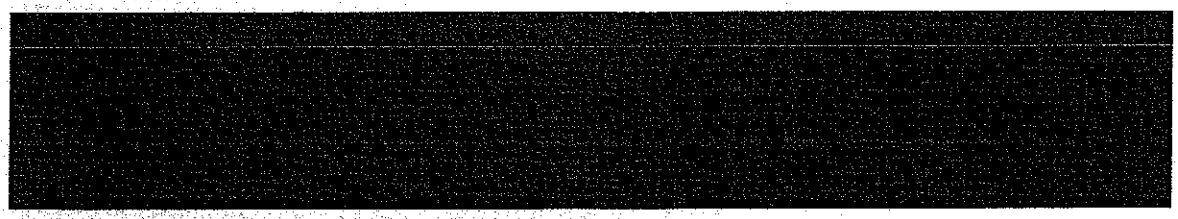
around the airport. Observations were noted during three shifts (day, evening, and night). The users were asked to check the COP frequently to verify that observed targets existed by selecting any target on the COP screen and using the long-range camera to visually verify the object.



CONCLUSIONS







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DHS/TSA
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LaGuardia International Airport – Friend-or-Foe System: Independent Verification and Validation Report

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September 2009

Final Report

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16. Supplementary Notes
This report was prepared by John Hunsucker of National Safe Skies Alliance

17. Abstract
This report describes the results of testing that National Safe Skies Alliance (Safe Skies) conducted in support of the Transportation Security Administration's Airport Perimeter Security Program, which was used to pilot security equipment at LaGuardia International Airport. Specifically, Safe Skies collected performance data regarding the Friend-or-Foe system, which combines Airport Surface Detection Equipment (ASDE-3) with Biometric Radio Frequency Identification (Bio-RFID) technology to create a system that tracks targets and authenticates the identities of badge carriers. Resultant data was statistically analyzed, when possible, and used to verify the system's basic functionality.

18. Key Words
APS Program, ASDE-3, Biometric, Bio-RFID, Friend-or-Foe, Independent Verification and Validation, LGA, Perimeter, Radar, RFID

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1.0	Final Draft/Charles Kelley	September 2009	

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LIST OF FIGURES

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EXECUTIVE SUMMARY

The Port Authority of New York and New Jersey (PANYNJ) installed a Friend-or-Foe identification and tracking system at LaGuardia International Airport (LGA) through the use of Airport Perimeter Security (APS) program resources that were provided by the Transportation Security Administration (TSA). National Safe Skies Alliance (Safe Skies), in cooperation with PANYNJ, conducted an independent verification and validation (IV&V) evaluation of the Friend-or-Foe system from July 20 – 24, 2009.

The Friend-or-Foe system was conceptualized to combine the capabilities of a remote biometric fingerprint authentication system with a Radar Identification (RAID) system in order to create a new form of access control and monitoring system that covers the outer perimeter areas of the facility. The system leveraged the Federal Aviation Administration's (FAA) Airport Surface Detection Equipment (ASDE-3 radar) to provide real-time radar tracking data for the Airport Security Display Processor (ASDP)[1], which enabled active tracking and monitoring capabilities, while a new form of Biometric Radio Frequency Identification (Bio-RFID) badge would provide remote biometric fingerprint authentication. Both technologies—ASDE-3/ASDP and Bio-RFID—were integrated so that both sets of data were fused and data could be displayed on a single Common Operating Picture (COP)[2], installed in the Operations Control Center (OCC). The Friend-or-Foe system was piloted in a confined area on the western region of LGA, highlighted in light blue in Figure 1.

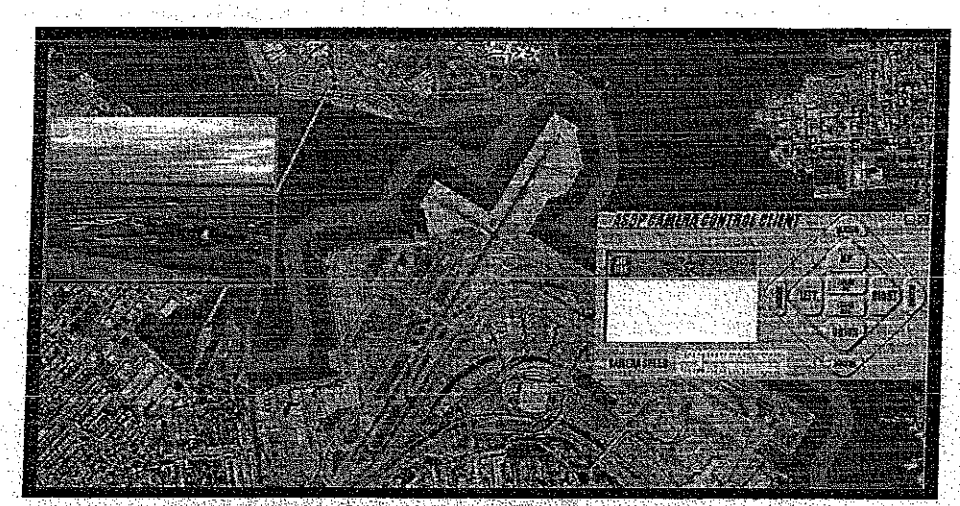

Figure 1. COP Screen Shot of LGA with Live Video Screen (Left Window) and Camera Control Screen (Right)

[1] The ASDP, a product of Technology Services Corporation (TSC), processes ASDE-3 radar information into data that is suitable for monitoring people and small vehicles that are within range of the radar.
[2] The COP is a computer terminal and large viewing screen where Bio-RFID and radar information is superimposed over a map of the airport.

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Bio-RFID Component

Figure 2. A-Box

The Bio-RFID system was composed of two primary components: the A-Box network and Bio-RFID badge. The A-Boxes (Figure 2) were compact communication systems that were the framework for the wireless mesh network and enabled two-way communication between Bio-RFID badges. An array of 20 of these devices was installed throughout the LGA perimeter.

The vendor selected A-Box locations in order to take advantage of existing power infrastructure, maximize badge detection, and utilize the most reliable communication paths (see Figure 3). In addition to communicating between badges and the network, the system was designed to triangulate and track a badge position by utilizing relative signal strength (RSS) measurements to approximate the location of a badge. Each badge discharged a signal beacon at a rate of 1 Hz, once per second. The beacon signal strength would be detected and measured by multiple A-Boxes, which would then provide estimated distance values. The system would then compile the measurements from some or all of the A-Boxes to triangulate an approximate location, which would be displayed on the COP screen.

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Figure 3. A-Box Locations at LGA

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A badge that enters the pilot area should have been detected by the A-box network. Security personnel would then view the badge on the COP and initiate an authentication request. The badge holder would be prompted, via a pulsating tone and series of flashing LEDs on the badge, to verify their identity by applying their biometric fingerprint to the sensor at the bottom of the badge. Upon a positive authentication, the badge holder's image would appear on the badge's screen. Figure 4 illustrates the Bio-RFID badge.

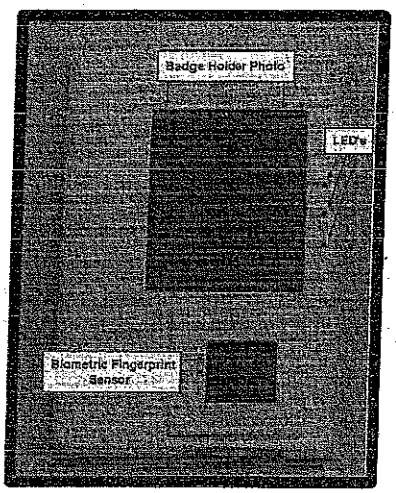

Figure 4. Bio-RFID Badge

Radar Identification (RAID) Component

The RAID component was also composed of several subsystems, combining existing FAA radar technology with a proprietary processing system called the ASDP. LGA currently uses ASDE-3 radar to monitor all ground control activity; however, the RAID system could also accommodate an ASDE-X[3].

The ASDP collected and processed information generated by the ASDE-3 and transmitted the resultant data to the COP in the OCC. The COP displayed tracking information (location and speed) for any targets detected by the radar on both land and water. LGA specified that the system should be tuned to [redacted]

Independent Verification and Validation Results

The Safe Skies evaluation was designed to verify that:

- Bio-RFID and RAID components merged and operated cooperatively
- Bio-RFID badges would respond to the authentication requests inside the pilot area and in the Operations Control Center (OCC)
- Bio-RFID would enroll personnel
- Bio-RFID badge battery life would last approximately 2 hr
- Bio-RFID badges would retain the biometric information 100% of the time
- Bio-RFID chargers (5 units) were all functional
- Bio-RFID badges (20 units) were all functional
- RAID system was functional and tracking targets
- RAID assessment camera was functional

[3] The RAID components are *not* compatible with ASDE-3X radars.

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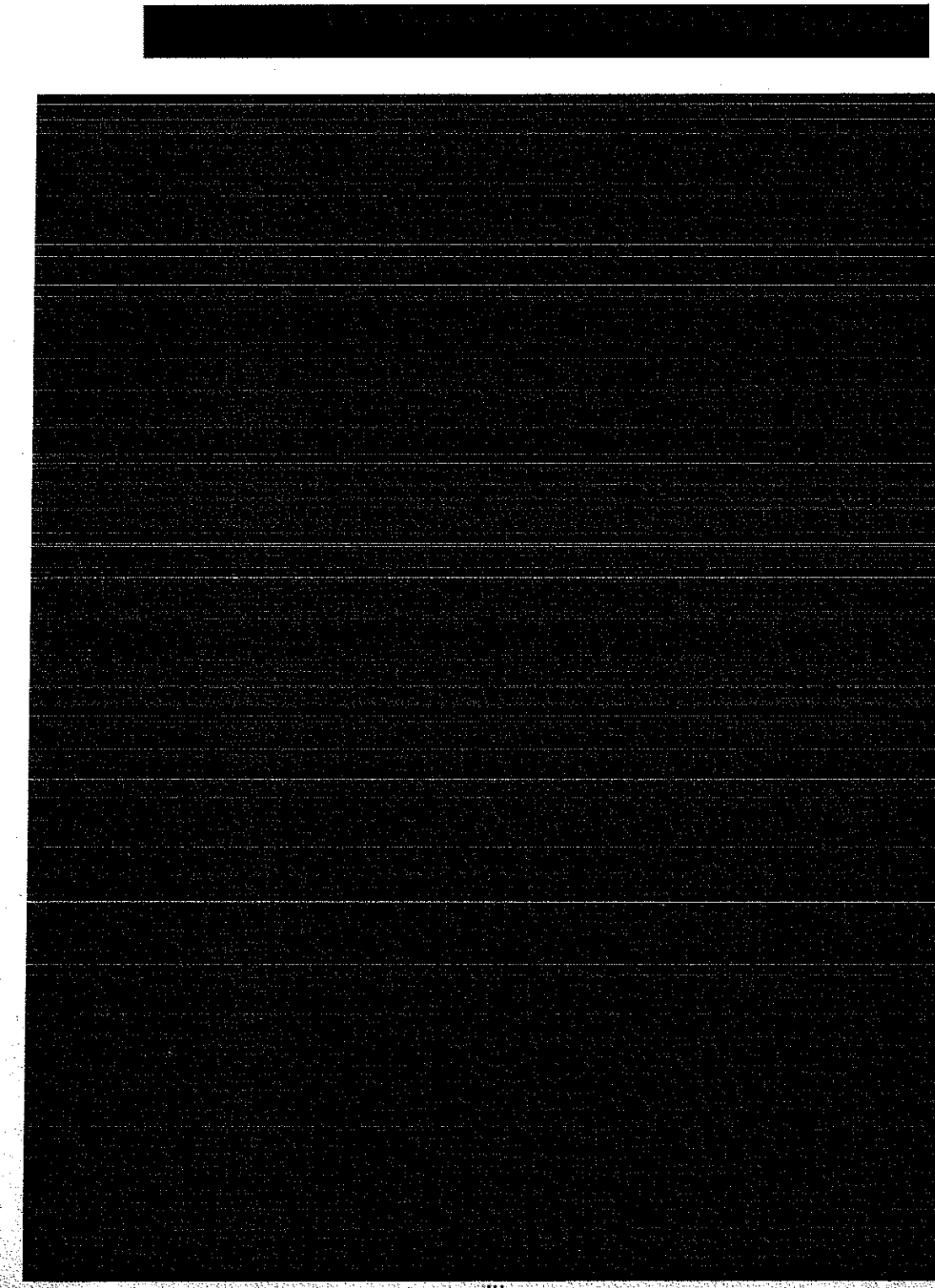

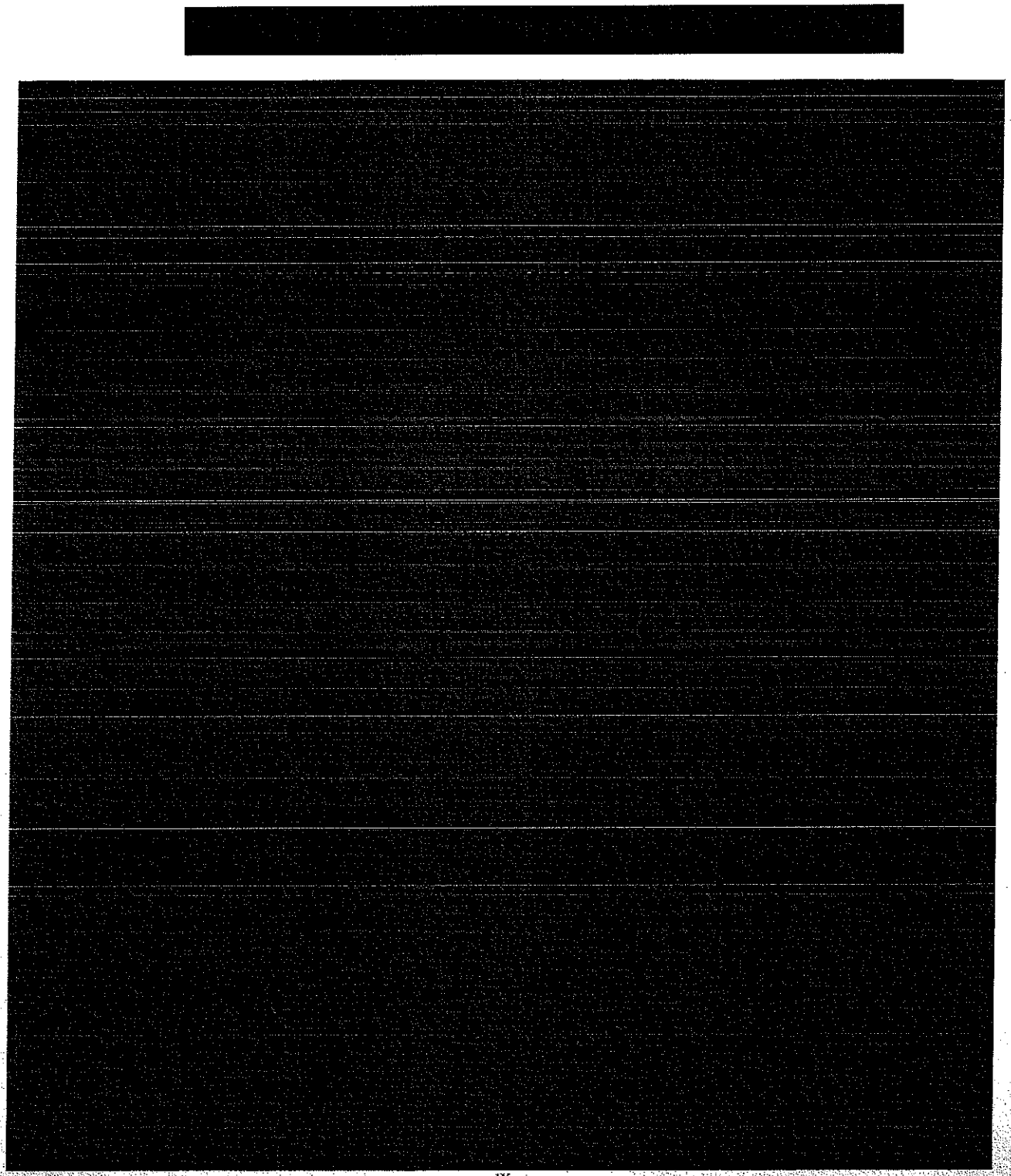

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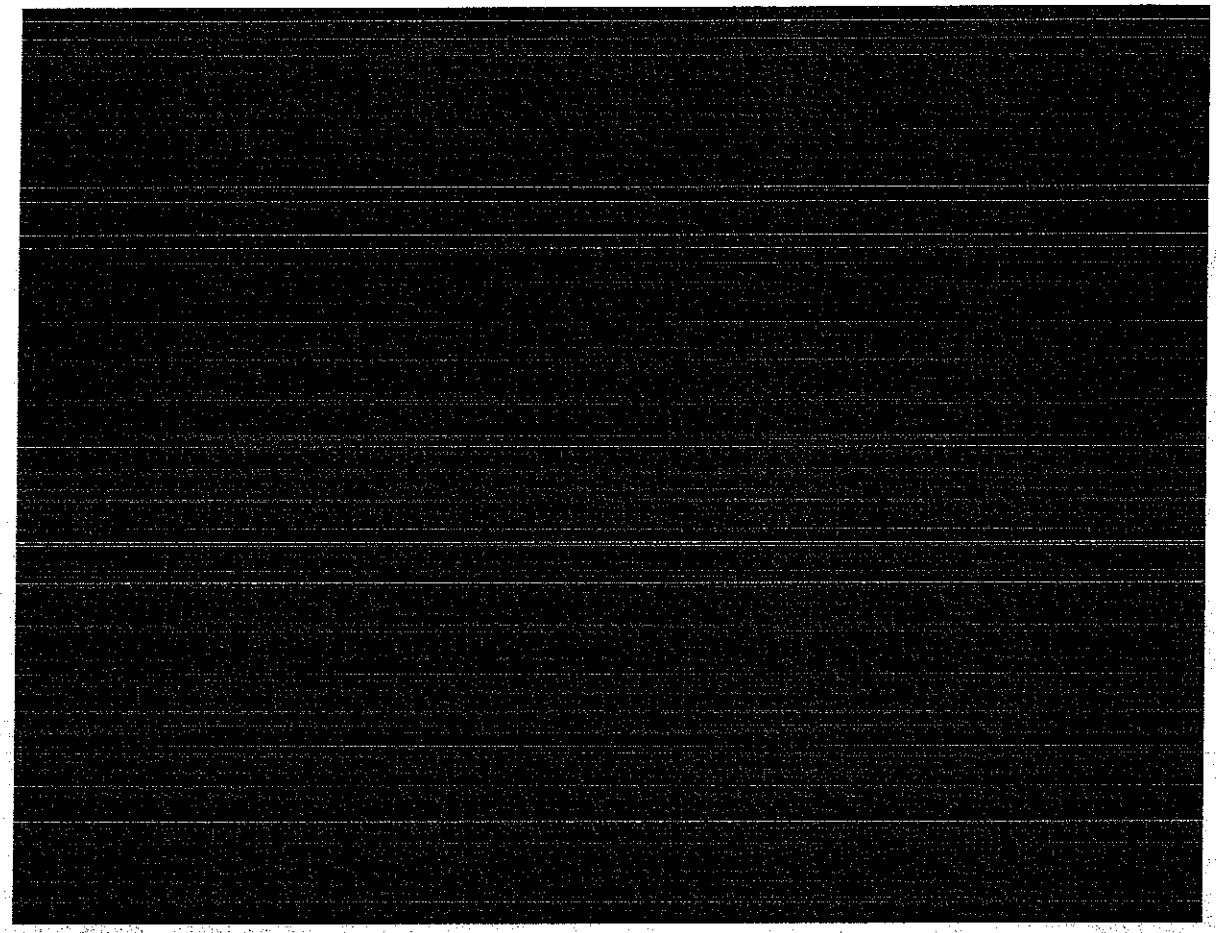

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ACRONYMS

ACB&P	Access Controls, Biometrics, and Perimeter
AOA	Air Operations Area
APS	Airport Perimeter Security
ASDE	Airport Surface Detection Equipment
ASDP	Airport Security Display Processor
ATCT	Air Traffic Control Tower
Bio-RFID	Biometric Radio Frequency Identification
COI	Critical Operational Issue
COP	Common Operating Picture
IV&V	Independent Verification and Validation
LGA	LaGuardia International Airport – FAA designation
LTE	Lead Test Engineer
MOE	Measure of Effectiveness
MOP	Measure of Performance
OCC	Operations Control Center
OT&E	Operational Testing and Evaluation
PANYNJ	Port Authority of New York and New Jersey
RAID	Radar Identification
TSA	Transportation Security Administration
TSC	Technology Services Corporation

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1. INTRODUCTION

The Port Authority of New York and New Jersey (PANYNJ) implemented a Friend-or-Foe identification and tracking system at LaGuardia International Airport (LGA) through the use of Airport Perimeter Security (APS) program resources that were provided by the Transportation Security Administration (TSA). National Safe Skies Alliance (Safe Skies), in cooperation with PANYNJ, conducted an independent verification and validation (IV&V) evaluation of the Friend-or-Foe system. Evaluation efforts took place at LGA, July 20 – 24, 2009.

The Friend-or-Foe system was conceptualized to combine the capabilities of a remote biometric fingerprint authentication system with a Radar Identification (RAID) system in order to create a new form of access control and monitoring system that covers the outer perimeter areas of the facility. The system leveraged the Federal Aviation Administration's (FAA) Airport Surface Detection Equipment (ASDE-3 radar) to provide real-time radar tracking data for the Airport Security Display Processor (ASDP)[5], which enabled active tracking and monitoring capabilities, while a new form of Biometric Radio Frequency Identification (Bio-RFID) badge would provide remote biometric fingerprint authentication. Both technologies—ASDE-3/ASDP and Bio-RFID—were integrated so that a fusion of the data could be displayed on a single Common Operating Picture (COP)[6], installed in the Operations Control Center (OCC).

1.1 Background

The TSA established the APS program to support the expansion and implementation of perimeter security technology at United States airports. Through this program, technologies are incorporated into an airport's security network to enhance its overall perimeter security infrastructure. As a requirement of the program, participating airports must submit the security technology for verification and validation by an independent evaluator.

Safe Skies is a non-profit organization that evaluates security technologies intended for airport facilities. Test Engineers assess technologies that have potential airport applications in order to provide reports, which emphasize operational performance in operational environments. These reports typically serve as informative guidelines for airport administrators and TSA officials when considering technologies for particular applications.

1.2 Purpose of Document

This document reports the findings of the Safe Skies IV&V of the Friend-or-Foe system at LGA. The following sections describe the methodologies used to conduct the effort, test scenario results, and any other relevant observations.

[5] The ASDP, a product of Technology Services Corporation (TSC), processes ASDE-3 radar information into data that is suitable for monitoring people and small vehicles that are within range of the radar.
[6] The COP is a computer terminal and large viewing screen where Bio-RFID and radar information is superimposed over a map of the airport.

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2. SCOPE

Safe Skies evaluated the Friend-or-Foe system at LGA in accordance with the Critical Operational Issue (COI) that was defined and approved in the project's Final Test Plan (*DHS/TSA 2600.02.01.09-138,* July 2009).

2.1 Objective

To verify that the system met airport and TSA expectations, Safe Skies collected data regarding:

- User enrollment
- User authentication – false rejections
- Power limitations and constraints
- Feedback from security personnel and general observations

2.2 Limitations and Assumptions

The COIs in the original Test Plan was developed under the following assumptions:

- Bio-RFID and RAID components worked cooperatively
- Bio-RFID badges would respond to the authentications within the pilot area and in the Operations Control Center (OCC)
- Bio-RFID would respond to the enrollment process
- Bio-RFID badge battery life would last approximately 2 hr
- Bio-RFID badges would retain the biometric information 100% of the time
- Bio-RFID chargers (5 units) were all 100% operational
- Bio-RFID badges (20 units) were all 100% operational
- RAID system was operational
- RAID Assessment camera was operational

2.2.1 Bio-RFID Badge Limitations

[redacted]

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2.2.2 RAID Limitations

[redacted]

3. SYSTEM INSTALLATION

3.1 System Outline and Description

The Friend-or-Foe system was conceptualized to combine the capabilities of a remote biometric fingerprint authentication system with a RAID system in order to create a new form of access control and monitoring system that covers the outer perimeter areas of the facility. The system leveraged the FAA's ASDE-3 radar to provide real-time radar information for the ASDP, which enabled active tracking and monitoring capabilities, while a new form of Bio-RFID badge would provide remote biometric fingerprint authentication. Both technologies—ASDE-3/ASDP and Bio-RFID—were integrated so that a fusion of the data could be displayed on a single COP, installed in the OCC. The pilot area is highlighted in light blue in Figure 6. Figure 7 shows the system configuration.

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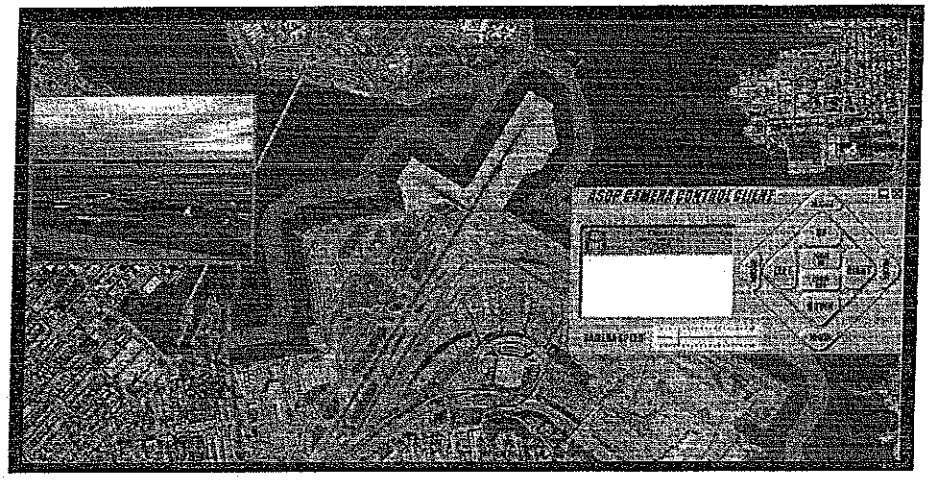

Figure 6. COP Screenshot of LGA with Live Video Screen (Left Window) and Camera Control Screen (Right)

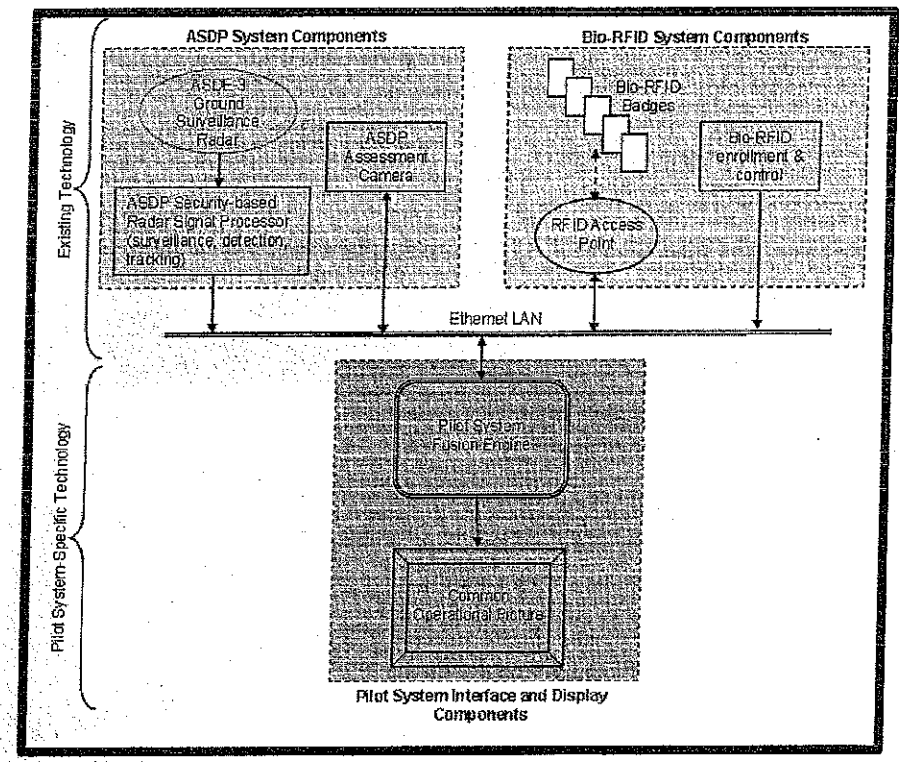

Figure 7. Friend-or Foe System Configuration

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3.1.1 TSC Radar Identification (RAID) Component

The RAID component of the system, provided by Technology Services Corporation (TSC), combined existing FAA radar technology with a proprietary processing system called the ASDP. LGA currently uses an ASDE-3 type radar to monitor all ground control activity; however, the RAID system can also accommodate an ASDE-X[7].

The ASDP (Figure 8), installed in the air traffic control tower (ATCT) collected and processed information generated by the ASDE-3, using the setup shown in Figure 9, and transmitted the resultant data to the COP in the OCC. The COP displayed all the tracking information (location

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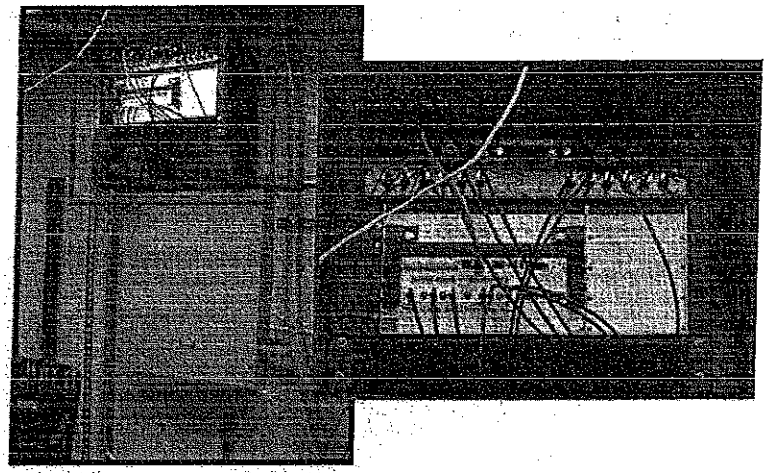

Figure 8. ASDP Isolator in the ATCT

[7] The RAID components were *not* compatible with ASDE-3x type radars.

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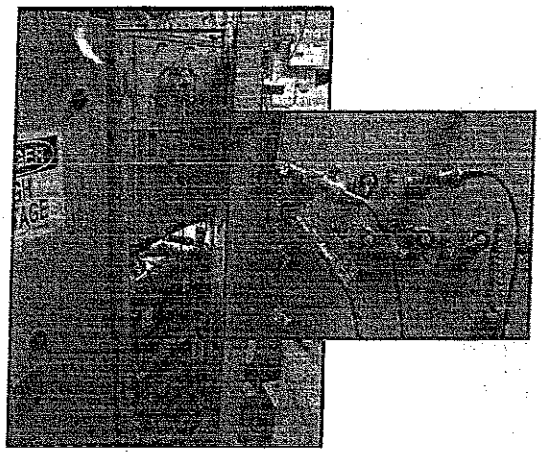

Figure 9. ASDP Isolator Cables Connected to the ASDE-3 Outputs

Targets identified via the ASDP are visually assessed through a long-range PTZ camera. The target information and video stream were combined at the COP, which provided the operator with an overview and real-time visual confirmation of any incident. Figure 10, below, shows screenshots from the COP at LGA. The live video feed is in the top left of the figure; the screen on the bottom right of the figure is an enlargement of the video window, and a vehicle that was being tracked by the ASDP. Figure 11 shows the assessment camera that was mounted to the ATCT.

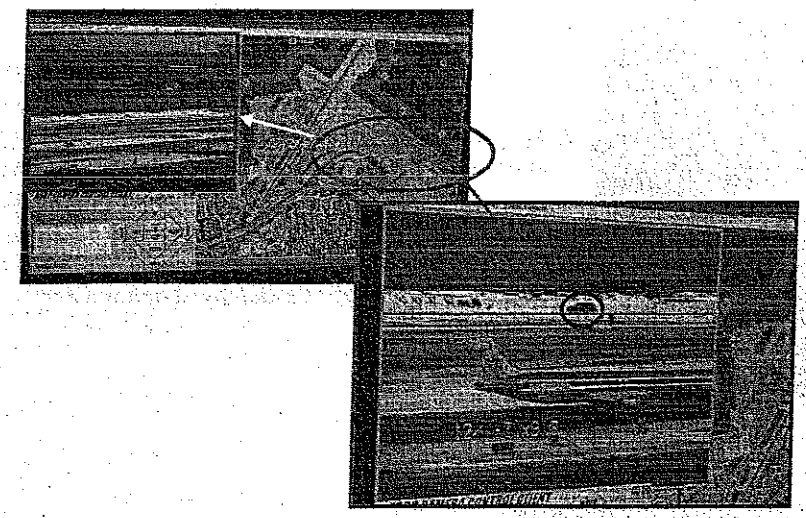

Figure 10. COP View with Live Video (Left) and an Enlargement of the Video (Right)

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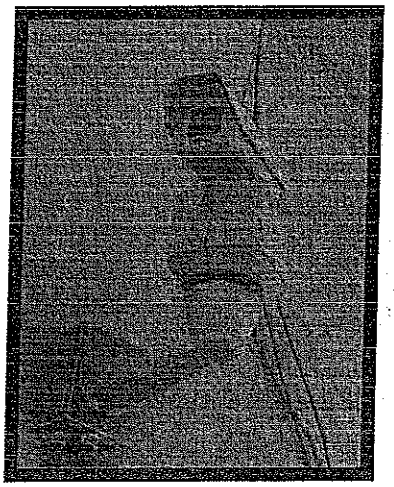

Figure 11. COP Assessment Camera Mounted on the ATCT

The assessment camera connected to the ASDP through a separate computer that calculated position data and tracked a target, providing information for the camera to automatically slew to an event. The COP user could task the camera to track a target and remain tracking until either the user forced it to stop or the ASDE-3 stopped providing tracking information.

The technical limitations of the ASDP system prevent it from being used in all airports. Currently, the ASDP is only capable of integrating with ASDE-3 and ASDE-X radar types[8].

3.1.2 Abeo Bio-RFID System

The Bio-RFID system was composed of two primary components: the A-box network and Bio-RFID badge. The A-Boxes (Figure 12) were compact communication systems that were the framework for the wireless mesh network and enabled two-way communication between Bio-RFID badges. These devices were installed throughout the LGA perimeter.

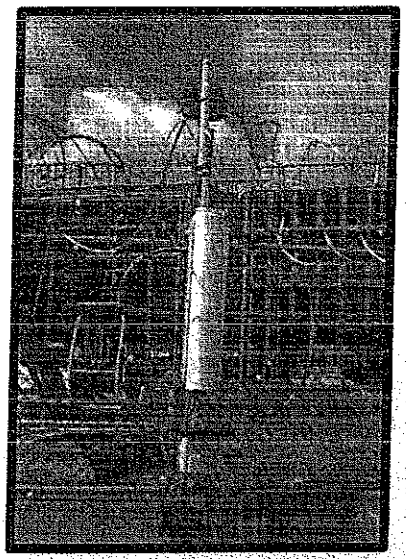

Figure 12. A-Box

The vendor selected A-Box locations to take advantage of existing power infrastructure, maximize badge detection, and use the most reliable communication paths (see Figure 13). The exact GPS coordinates for the locations are provided in Appendix A.

In addition to communicating between badges and the network, the system was designed to triangulate and track a badge position using relative signal strength (RSS) measurements to approximate the location of a badge. Multiple A-Boxes would detect a badge's beacon signal strength from the badge's beacon; the system would then compile the measurements to triangulate an approximate location, which would be displayed on the COP screen.

[8] The system does *not* currently integrate with the ASDE-3x.

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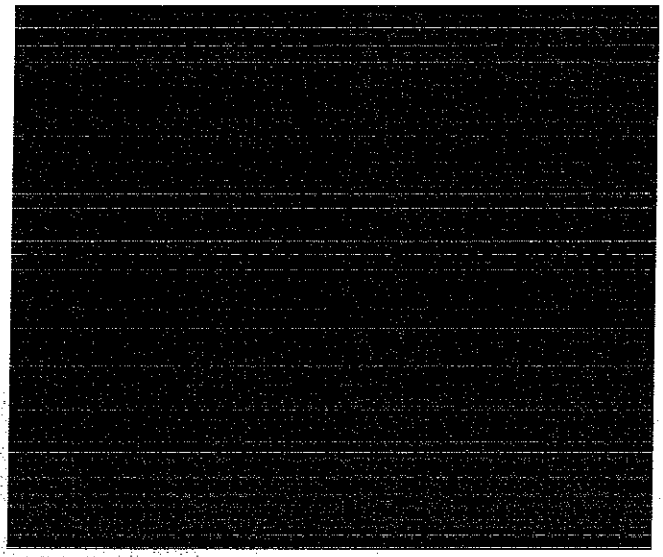

Figure 13. A-Box Locations at LGA

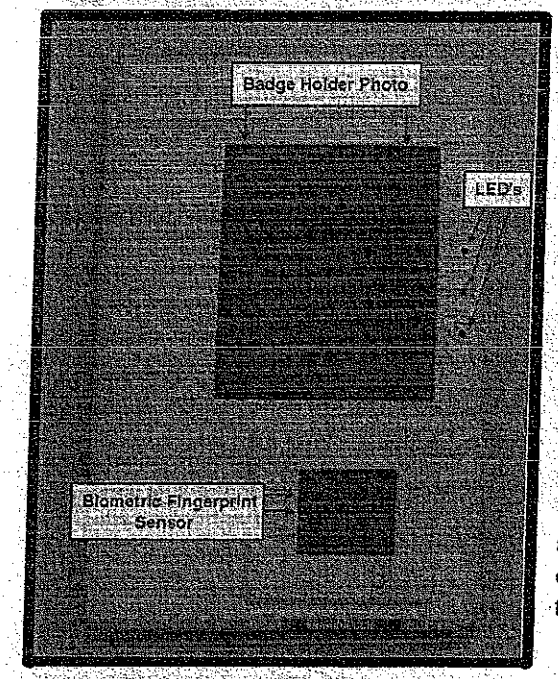

Figure 14. Bio-RFID Badge

The A-Box network should have detected a badge that entered the pilot area. Security personnel would then view the badge on the COP and initiate an authentication request. The badge holder would be prompted, via a pulsating tone and series of flashing LEDs on the badge, to verify their identity by applying their biometric fingerprint to the sensor at the bottom of the badge. Upon a positive authentication, the badge holder's image appears on the badge's screen. Figure 14 illustrates the Bio-RFID badge.

The Bio-RFID badge was equipped with a biometric fingerprint reader, a radio transmitter/receiver, a rechargeable battery, on-board memory, micro-audio/visual components, and digital photo ID. The on-board memory was designed to store up to three biometric fingerprint templates.

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4. METHODOLOGY

4.1 Schedule

LGA has been using the ADSP and ASDE-3 radar components since Q4 2008. The Bio-RFID component was finalized in July 2009. Safe Skies conducted IV&V testing July 20 – 24, 2009.

4.2 Site

All testing was conducted within the AOA of LGA. Figure 15, below, shows an aerial view of the pilot area, and the locations selected for assessment procedures.

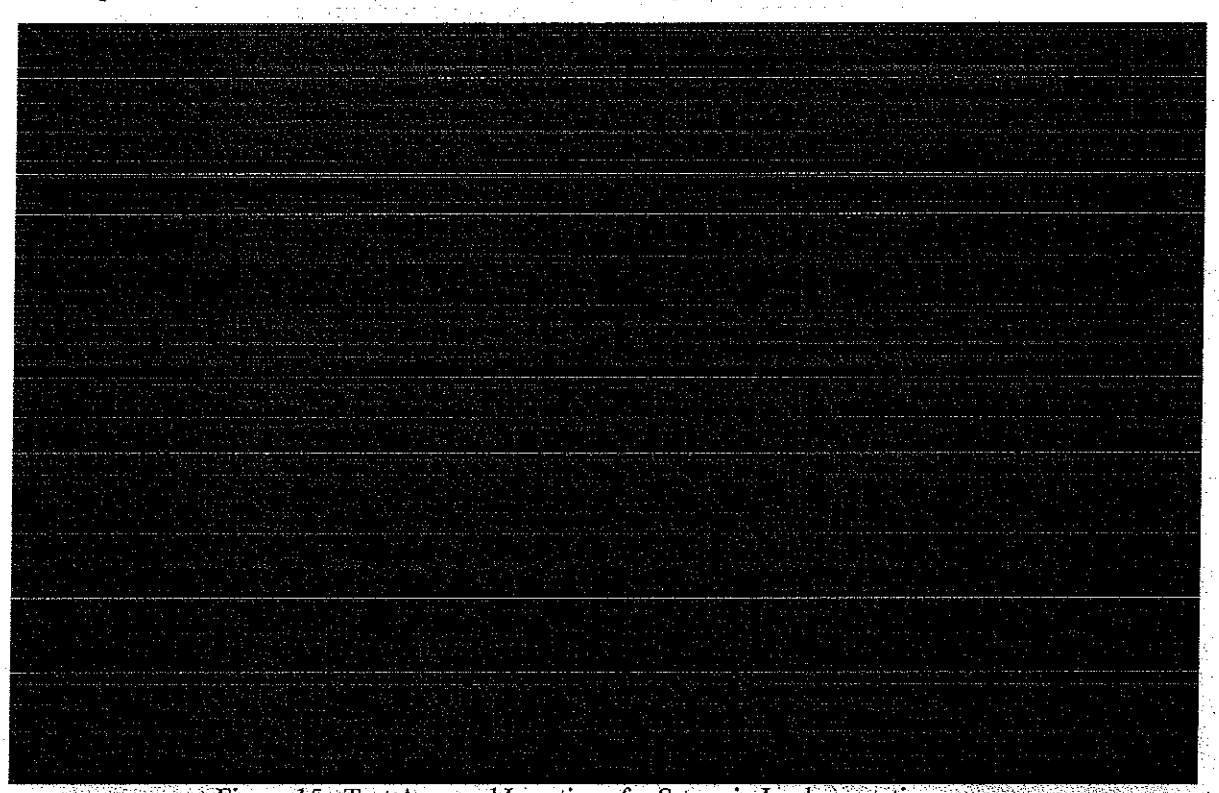

Figure 15. Test Area and Locations for Scenario Implementation

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4.3 Test Subjects

[redacted]

4.4 Test Equipment

Safe Skies used a GPS device to determine the exact locations of equipment and test sites, and to verify geospatial coordinates on the COP.

4.5 Critical Operational Issue

The primary objective of this evaluation was to resolve the COI that was identified in the project's test plan. Procedures and data collection processes were developed based on Measures of Effectiveness (MOE) and Measures of Performance (MOP) to generate qualitative and quantitative data.

COI: Does the Friend-or-Foe system meet LGA security expectations?		
MOE	**MOP**	
1 Does the Bio-RFID technology operate as expected?	**A**	Report observed enrollment
	B	Report the observed false rejections.
	C	Report the observed false acceptances.
	D	Report the accuracy of the target's location coordinates.
2 Does the ASDE-3 tracking equipment operate as expected?	**A**	Report the accuracy of the target's location coordinates.
	B	Report on the state of the geospatial tracking.
	C	Report on the tracking capability outside of the Bio-RFID antenna area.
3 Maintenance and Use Issues	**A**	Does the COP display accurate target information?
	B	Are there features of the COP that security personnel felt improved or hindered operations?
	C	Does the system generate nuisance alarms[9]? If so, attempt to identify the rate and conditions of the alarm.
	D	Does the system generate false alarms[10]? If so, attempt to identify the rate and conditions of the alarm.
	E	Are there any maintenance requirements of the system? If so, identify them.
	F	Report actual battery life of the badges.

[9] ***Nuisance Alarms*** are instances in which the system detects and alarms on an object or an activity that exists, but is not necessarily a threat. Nuisance alarms have discernable causes.

[10] ***False Alarms*** are instances in which the system detects and alarms but is not necessarily a threat and has no discernable cause.

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5. RESULTS

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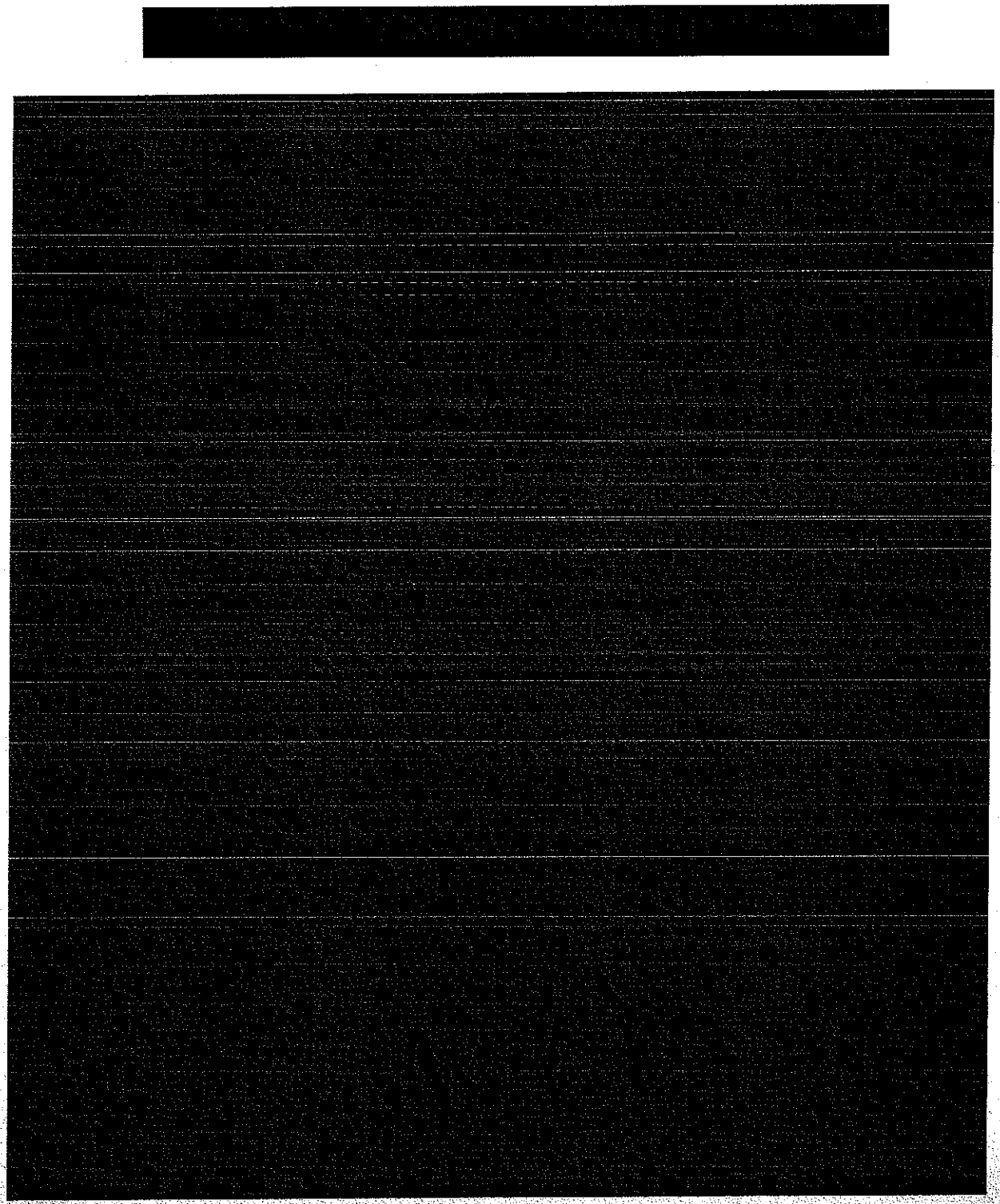

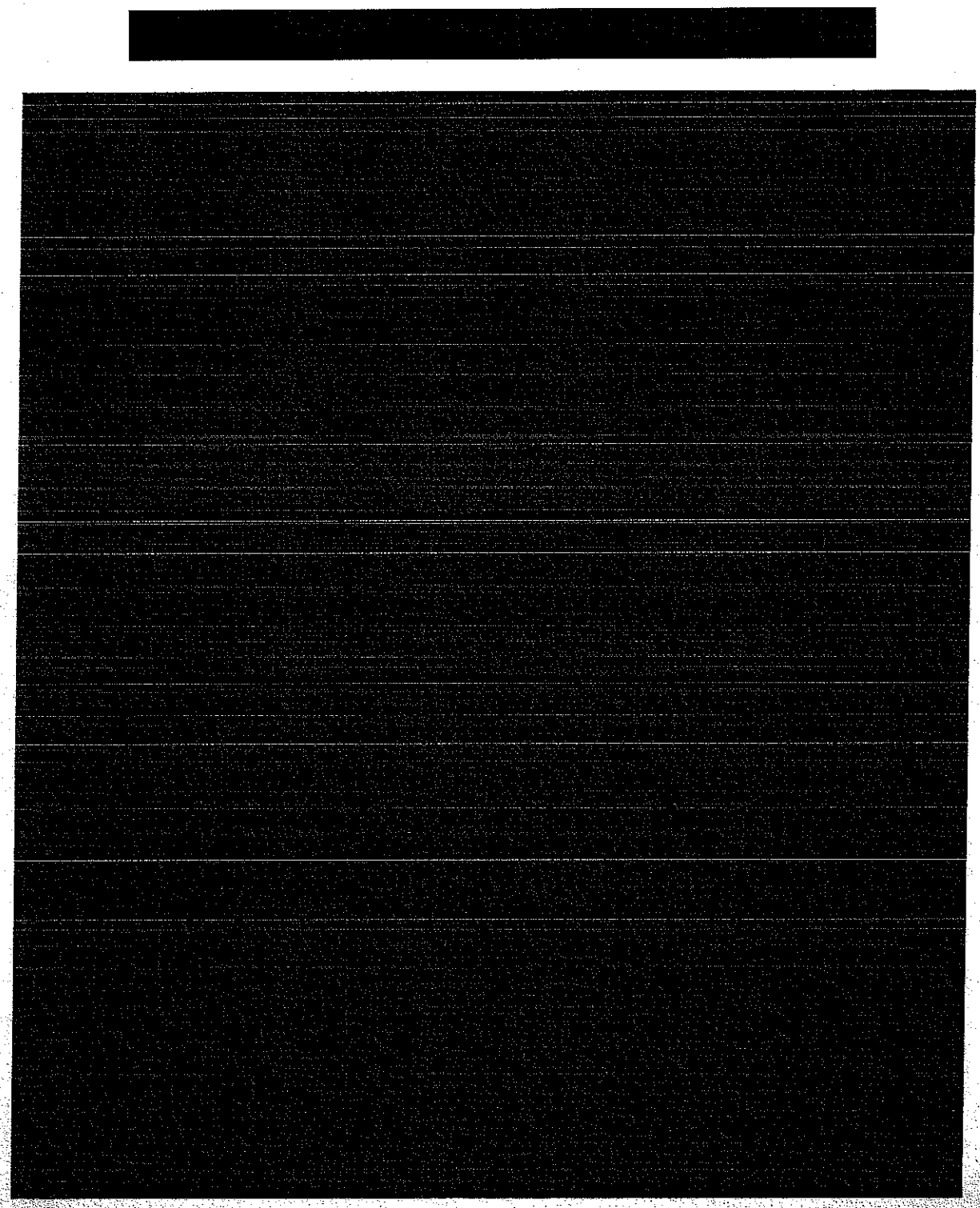

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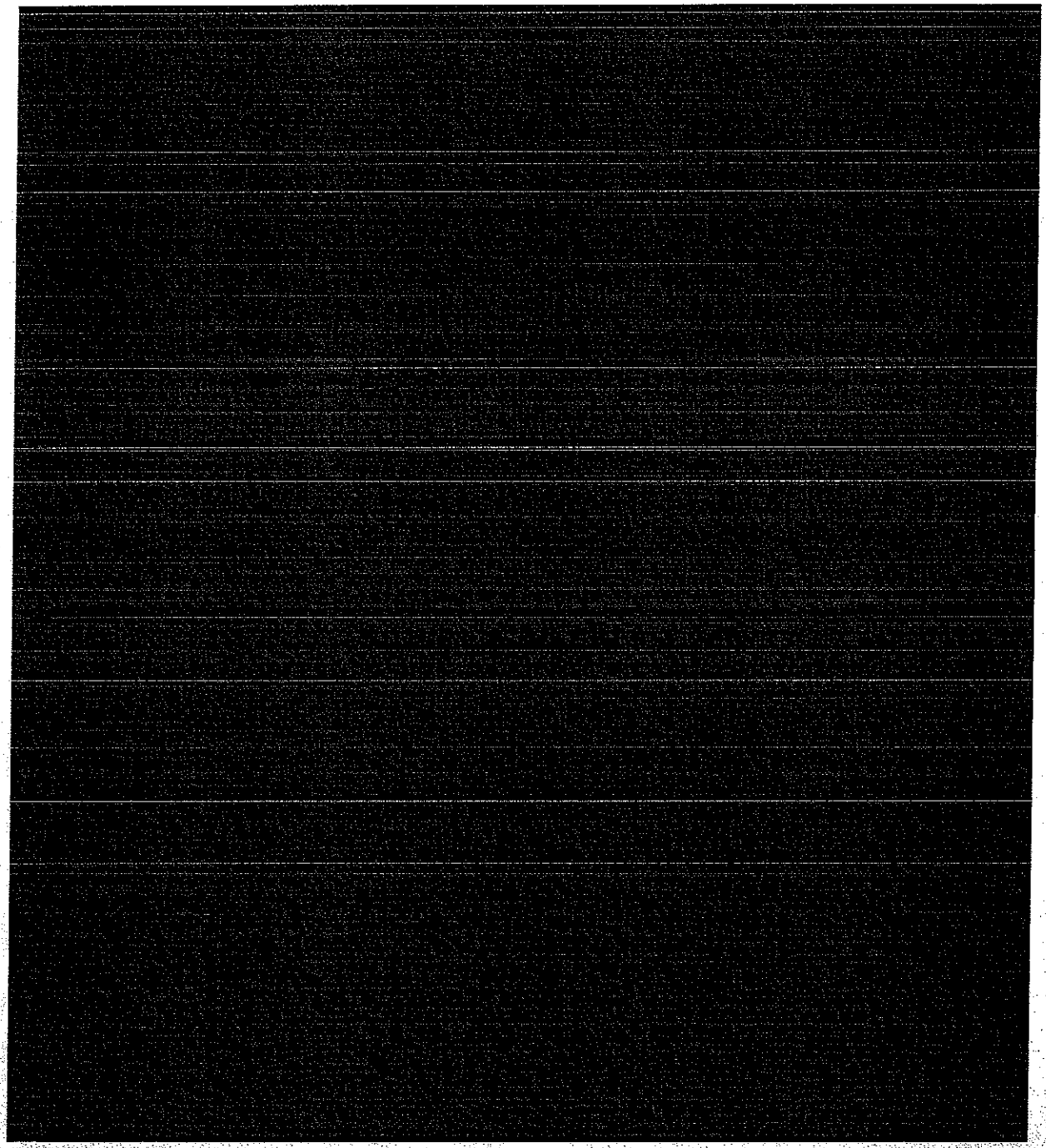

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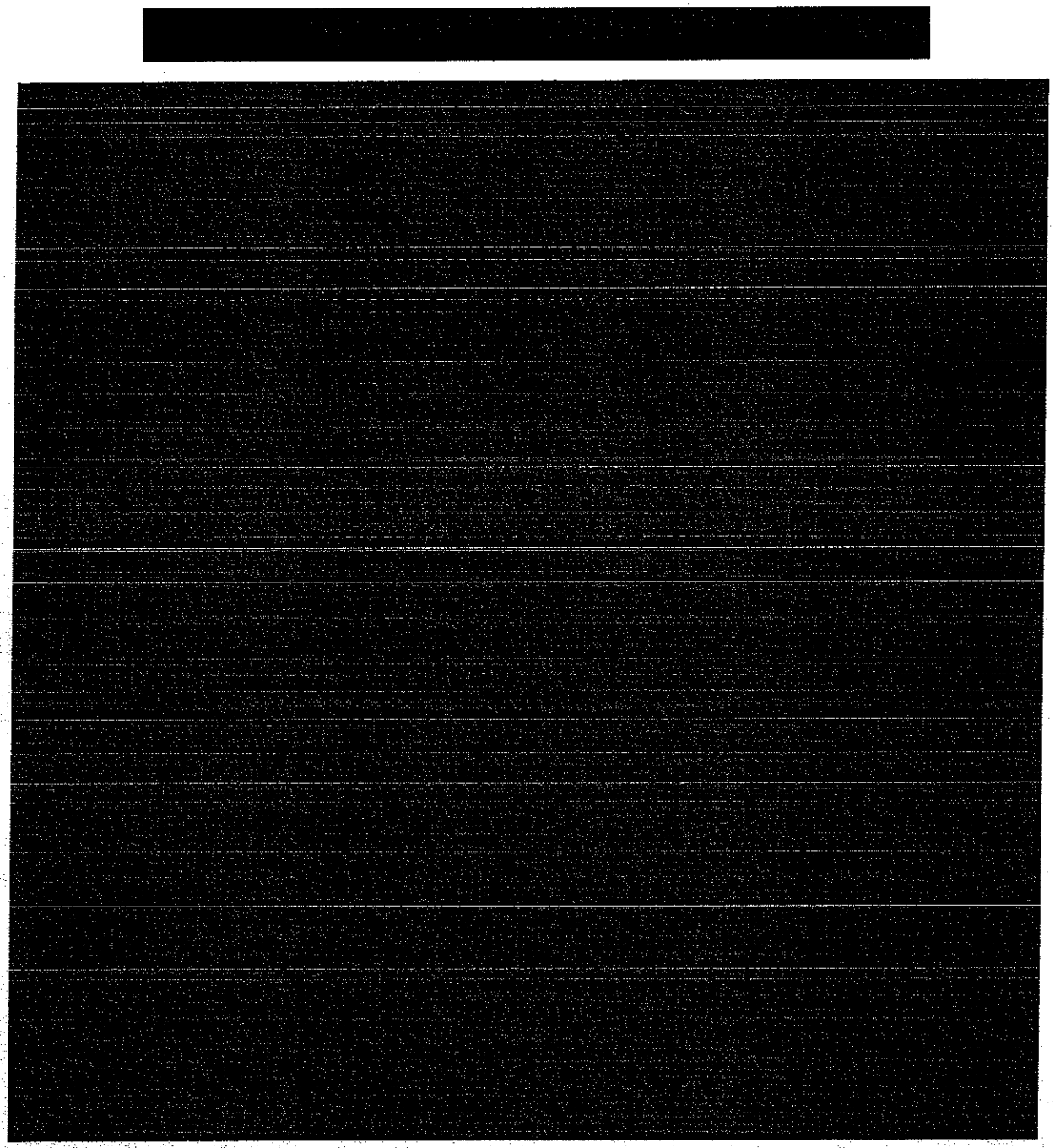

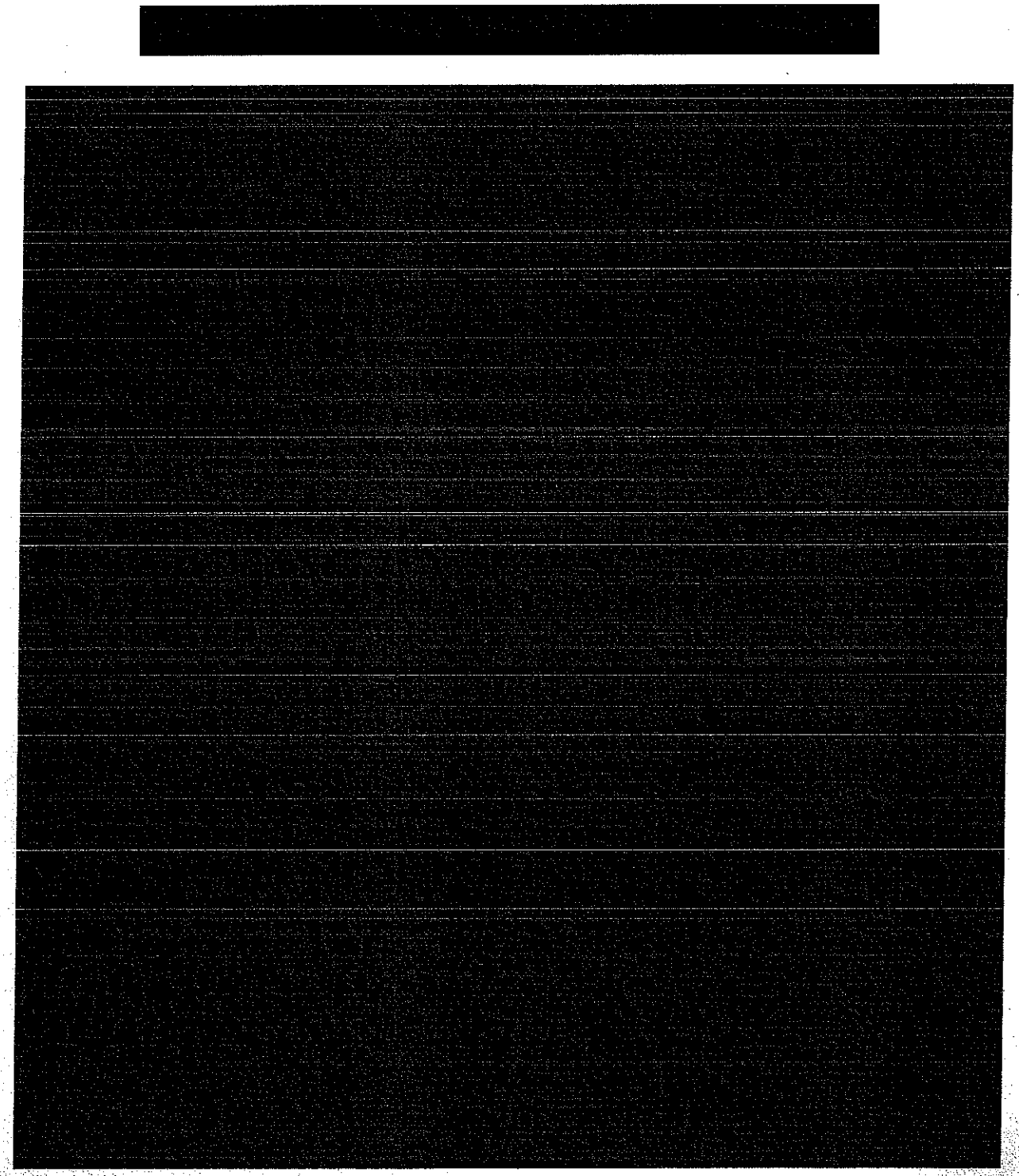

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6. CONCLUSIONS

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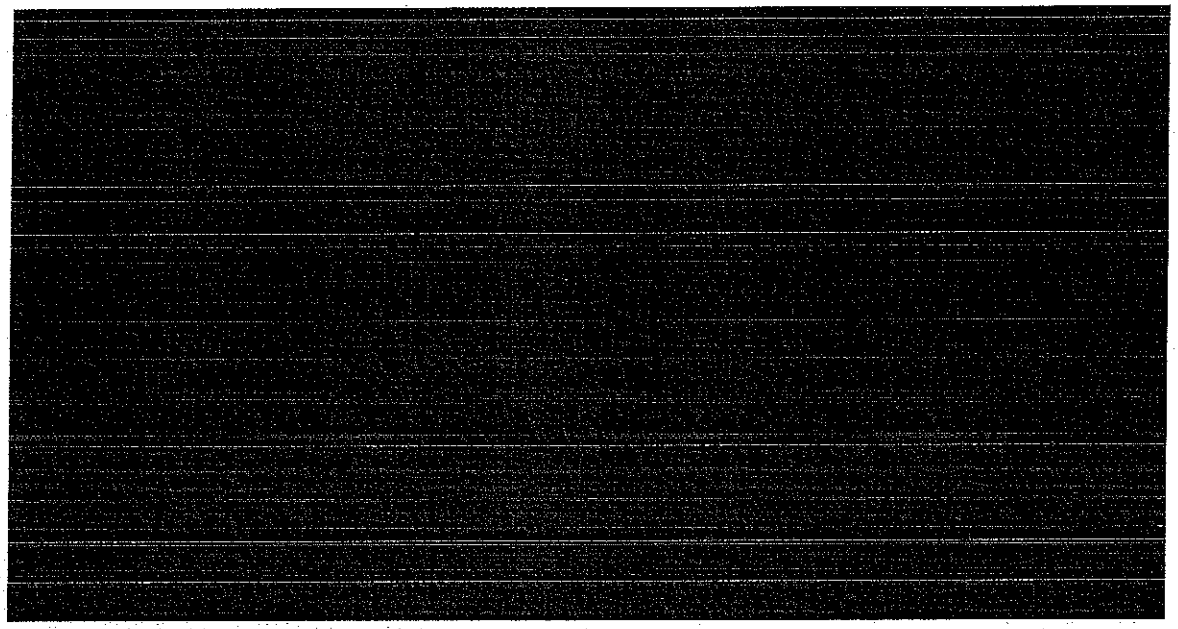

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APPENDIX A – TEST LOCATION GPS COORDINATES

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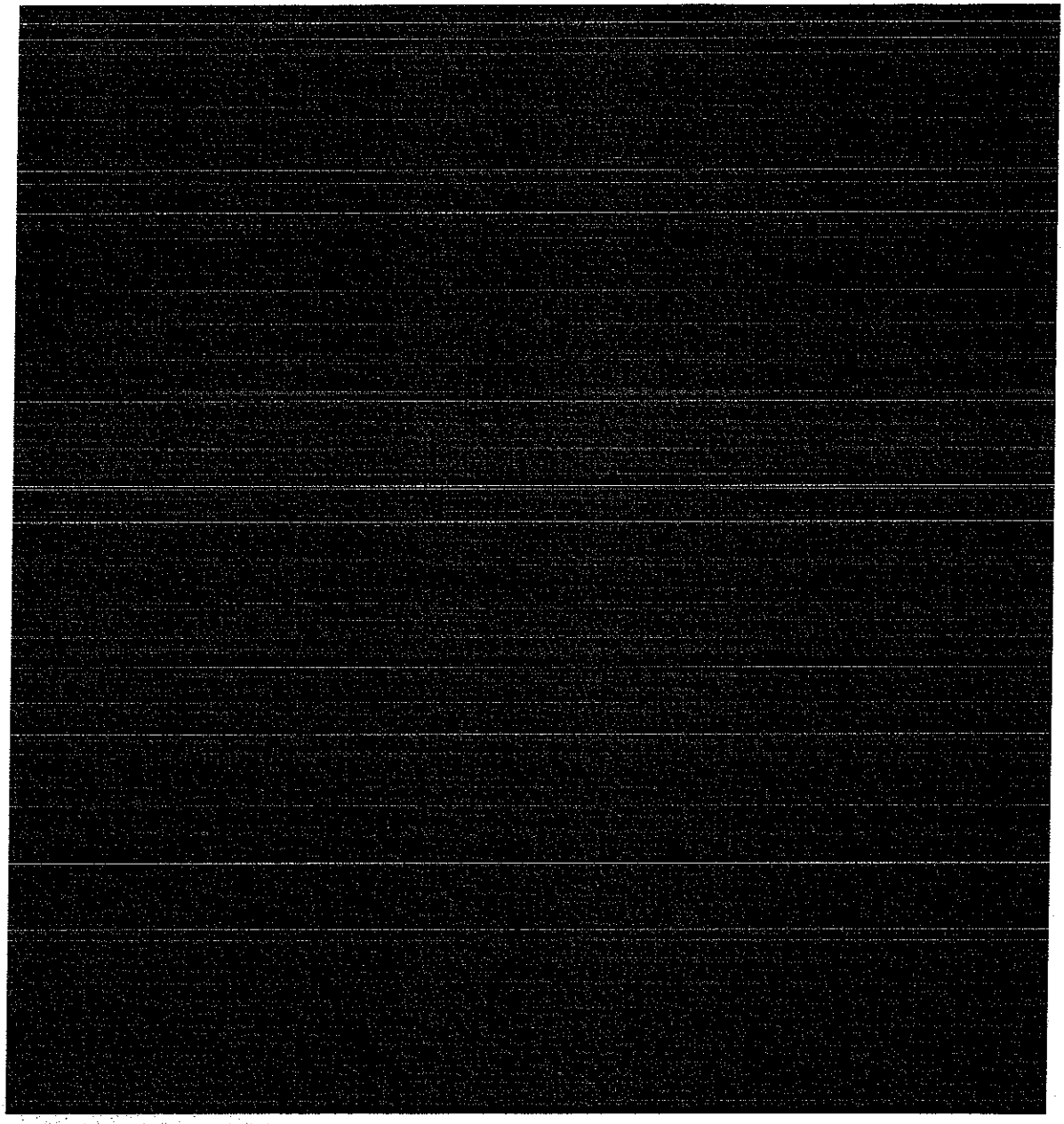

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